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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

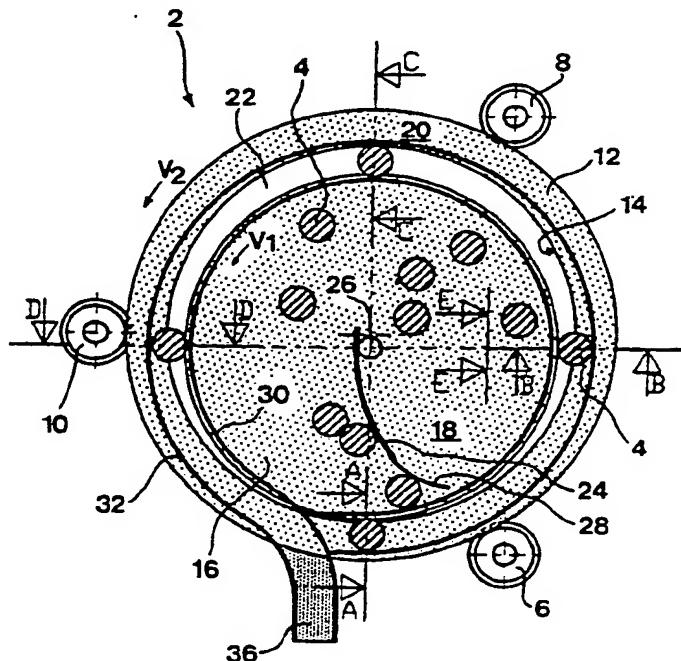
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(54) Title: DEVICE FOR SORTING DISC-SHAPED PRODUCTS

(57) Abstract

The invention relates to a device for sorting out round, flat products deviating from a predetermined shape. The device comprises a curved channel defined by an inner sideboard (30) and an outer sideboard (32). The inner sideboard (30) is arranged immediately above the top face (18) of a rotary disc (16) whose rim portion forms a first part of the bottom of the channel. A circular ring (12) is arranged eccentrically in relation to the disc (16) and rotates at a higher speed than the disc. The top face (20) of the ring (12) is located in the same plane as the top face (18) of the disc (16). The inner diameter of the ring (12) exceeds the outer diameter of the disc (16). The width of a gap (22) between the ring (12) and the disc (16) varies in the circumferential direction and maximally is but slightly smaller than the diameter of the product. The part of the top face (20) of the ring (12) which is located inwardly of the outer sideboard (32) forms a second part of the bottom of the channel. A slot (34) provided in the inner sideboard (30) has such a length and such a height that a product can pass under the inner sideboard (30) into the channel.



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DEVICE FOR SORTING DISC-SHAPED PRODUCTS.

The present invention generally relates to a device for feeding circular, flat objects, such as tablets of 5 different types, from a manufacturing plant, an intermediate storage or the like, to a packing station or a storage for finished products. More specifically, the invention relates to a device which is designed for sorting round, flat products, especially different types of tablets, and which while feeding the tablets sorts out such 10 tablets as deviate from a predetermined shape.

The term "tablets" as used herein generally refers to pharmaceutical products in solid form, such as tablets for chewing, swallowing or tablets in the form of effervescent tablets, but the present application also comprises other products in tablet form on which special demands are placed in respect of dosage etc., such as detergents in the form of effervescent tablets.

Sorting tablets in a production line may be done continuously or batchwise, the tablets discharged from a tablet press being passed, when fed towards the packing station, through a sorting device, in which damaged tablets or tablets of a shape deviating from a predetermined one are sorted out. Sorting out such damaged or shape-deviating 20 tablets is not done for aesthetic reasons only, but primarily to meet the demands for dosing safety that are placed on pharmaceutical products, especially in tablet 25 form.

This problem has faced many people in the trade, and 30 a number of solutions have been suggested to solve it. In applicant's view, the state of the art is described in DE-OS-21 25 666, which relates to a device for sorting tablet-like objects, and in WO 89/09098, which relates to a method and a device for sorting round objects.

35 A distinctive feature of the device disclosed in DE-OS-21 25 666 is that tablets are caused to pass a driven roller or disc pressing each tablet against an outer wall

of a downwardly open channel in this section. Tablets having too small a diameter will not be engaged with the disc and the outer wall, but drop through the opening in the bottom of the channel.

5       The device described in WO 89/09098 has only a remote bearing on the technical field described in this application. The known device is designed for sorting out capsules deviating from a desired shape, in a two-step operation. The capsules pass into "pockets" in a rotary disc, 10 undersize capsules falling out of the pockets in a first step. In the second step, oversize capsules are sorted out by measuring the time during which a capsule remains in the second sorting step. Thus, oversize capsules will remain longer in the second sorting step than capsules 15 having the desired shape, and are discarded. The device disclosed in WO 89/09098 is of a complex design, which makes such a device quite costly. Without extensive modifications, it would not be possible to use this device for sorting tablets according to the present invention.

20       In practical use, the device according to DE-OS-  
21 25 666 has also been found to suffer from a number of shortcomings, of which only a few are mentioned here. One 25 drawback of the device of DE-OS-21 25 666 is that the tablets are fed serially to the sorting disc. Although the sorting disc has quite a high rotational speed, the capacity of the device is comparatively limited and considerably falls short of the capacity of the tablet press and modern packing stations, which results in a bottleneck in production. Another drawback is that the tablets are 30 pressed against a stationary outer wall, which may give rise to damage, especially in the handling of fragile products, such as effervescent tablets or tablets with a large diameter-to-thickness ratio. This means that the amount of waste increases to a considerable extent and 35 that the damage to the tablet may take place at the end of the downwardly open section of the channel, with a consequent risk that an edge-damaged tablet or tablet divided

into two is fed to the packing station. Thus, the quite rough handling of the tablets in the device disclosed in DE-OS-21 25 666 is best, if at all suited for relatively thick, compact tablets having a relatively small diameter.

5 A first object of the present invention is thus to provide a sorting device which, during simultaneous feeding, is more gentle on the products fed to it.

A second object of the invention is to provide a feeding and sorting device whose capacity is conformed to  
10 the capacity of the tablet press and/or the packing station.

A third object of the invention is to provide a feeding and sorting device which is of a relatively simple design and, hence, cost-effective.

15 These and further objects of the invention are achieved by means of a device for sorting round, flat products, comprising a channel and a disc rotating at a speed  $v_1$  and intended to engage each product, the device being characterised in that the channel is formed by an inner  
20 sideboard and an outer sideboard which constitute the side walls of the channel, that the inner sideboard is arranged immediately above the top face of the disc, inwardly of the disc rim, the rim portion of the disc forming a first part of the bottom of the channel, that the outer side-  
25 board is arranged at a constant distance from the inner sideboard which but slightly exceeds the diameter of the product, that a circular ring is arranged eccentrically in relation to the disc, that the top face of the ring is located in the same plane as the top face of the disc,  
30 the ring having an inner diameter exceeding the outer diameter of the disc, there being formed between the circular ring and the disc a gap whose width varies in the circumferential direction and maximally is only slightly smaller than the diameter of the product, the part of the top face  
35 of the ring located inwardly of the outer sideboard forming a second part of the bottom of the channel, and that a slot is provided in the inner sideboard and has such a

length and such a height that a product situated on the top face of the disc can pass under the inner sideboard into the channel, the product being conducted out of the channel at the end thereof as a result of a corresponding

- 5 design of the inner sideboard and of the outer sideboard.  
Other features of the invention will appear from the dependent claims.

A preferred embodiment of the present invention is described in more detail hereinbelow with reference to the  
10 accompanying drawings.

Fig. 1 is a top plan view of a feeding and sorting device according to the invention with a plurality of tablets fed to the device.

Fig. 2 is a partly broken-away sectional view taken  
15 along the line A-A in Fig. 1.

Fig. 3 is a partly broken-away sectional view taken along the line B-B in Fig. 1.

Fig. 4 is a partly broken-away sectional view taken along the line C-C in Fig. 1.

20 Fig. 5 is a partly broken-away sectional view taken along the line D-D in Fig. 1.

Fig. 6 is a partly broken-away sectional view taken along the line E-E in Fig. 1.

Fig. 1 shows a device 2 for sorting and feeding tablets 4 from a tablet press or an intermediate storage to a packing station or a storage for finished products. The device comprises a circular ring 12 supported by rollers 6, 8, 10. At least one roller 6, 8 or 10 is driven and engages the circular ring 12. The engagement between the driving roller (rollers) is brought about in known manner by frictional contact between the roller and the ring, or in any other suitable manner, for instance by providing the outer edge of the ring with teeth meshing with a driving roller designed as a gear wheel. Thus, the circular ring 12 is driven at a rotational speed  $v_2$  in a given direction, clockwise or counterclockwise. A circular disc 16 disposed inwardly of an inner edge 14 of the circular

ring 12 has a top face 18 located in the same plane as a top face 20 of the ring 12. The centre of the disc is however offset in relation to the centre of the ring. The disc 16 has such a diameter that there is formed a gap 22 between the outer edge of the disc and the inner edge 14 of the ring, the width of this gap varying in the circumferential direction of the disc 16 because this is eccentrically disposed in relation to the circular ring 12.

5 Also the disc 16 is driven, either by being mounted directly on the shaft of a motor (not shown) or in any other convenient manner, for instance via a belt pulley mounted on a common shaft. The disc is driven at a speed  $v_1$  and rotates in the same direction as the circular ring 12, clockwise or counterclockwise. The speed  $v_1$  is however

10 15 different from the speed  $v_2$  for reasons which will be given further on in connection with the description of the operation of the device.

An arm 24 is extended in a plane parallel to the disc and to the ring, and is mounted in a suitable manner immediately above the top face 18 of the disc. Thus, one end of the arm 24 may be mounted at a pin 26 at the centre of the disc. The other end of the arm 24 is cantilevered and, in a preferred embodiment of the invention, connected to a flexible member 28. The arm 24 may however be mounted in another way, for instance by means of a clamp (not shown) fixing the arm in the desired position. In this case, the arm is not cantilevered, which is not compulsory for achieving the technical function aimed at. In a preferred embodiment of the invention, the arm 24 and the optional,

20 25 30 flexible member 28 are bent away from the pin 26 in the direction of rotation of the disc.

In addition to the arm and the optional, flexible member, the device 2 has an inner sideboard 30 and an outer sideboard 32, which are concentrical with the disc 35 16. The distance between the inner sideboard 30 and the outer sideboard 32 is thus constant and only slightly greater than the diameter of the type of tablet to be

sorted. The inner sideboard 30 is arranged immediately above the top face 18 of the disc at a small distance inwardly of the disc edge. The outer sideboard 32 is disposed at a constant distance from the inner sideboard 5 which only slightly exceeds the diameter of the tablet type concerned, immediately above the top face 20 of the circular ring. Since the respective centres of the ring and the disc are offset with respect to each other and the distance between the inner edge 14 of the ring and the rim 10 of the disc thus varies depending on the circumferential position, also the surface of the top face 20 of the ring located inwardly of the outer sideboard 32 will vary. As mentioned above, the maximum width of the gap 22 is but slightly smaller than the diameter of the tablet type concerned. Therefore, the inner edge 14 of the circular ring 15 is always located between the outer sideboard 32 and the inner sideboard 30. As will be readily appreciated, the surface of the top face 20 of the ring enclosed between the outer sideboard 32 and the inner sideboard 30 will 20 however vary.

As appears especially from Figs 2 and 3, the inner sideboard 30 is provided, within a certain section thereof, with a slot 34 extending in the circumferential direction. The slot 34 has a height which slightly exceeds the 25 thickness of the tablet type concerned. Since the height of the slot is limited, only one tablet at a time can pass through it under the inner sideboard 30 and into the channel defined between the outer sideboard 32 and the inner sideboard 30. It has proved advantageous to give the slot 30 a length corresponding to a quarter, or slightly more, of the circumference of the inner sideboard 30. The beginning of the slot thus corresponds to the beginning of the channel. At the end of the circular channel, this passes into a duct 36 which faces away from the device 2 and which may 35 lead to a product distributor in a modern type of packing machine, like the one described in SE-C-8902552-2.

The function of the embodiment of the invention related above will now be described. Reference is made especially to Figs 2-6 which as partly broken-away sectional views illustrate different phases when sorting 5 circular, flat products.

Initially, reference is however made to Fig. 1. A plurality of tablets 4 are fed continuously, or batchwise, to the device 2 and enter on the right-hand part of the disc 16 shown in Fig. 1. In this embodiment, the disc 16 10 and the circular ring 12 rotate counterclockwise. The tablets are lying on the top face 18 of the disc and are moved along with the disc during its rotation. The tablets 4 encounter the arm 24 which is curved in the direction of rotation, and are gently pushed towards the rim of the 15 disc. In a particularly preferred embodiment of the invention, the arm 24 is connected to a flexible member 28 which, by an increased load caused by a plurality of tablets engaging the arm, is bent still further and may let through a number of tablets which will accompany the disc 20 another revolution. The tablets 4 are fed by means of the arm 24 and the flexible member 28 through the slot 34 in the stationary inner sideboard 30 and out into the channel between the inner sideboard 30 and the outer sideboard 32. This position is illustrated in Fig. 2, where the major 25 part of a tablet 4 rests on the top face 20 of the circular ring which, like the disc 16, rotates counterclockwise in the embodiment shown in Fig. 1. The spacing between the tablets fed into the channel increases, and each tablet starts rotating because the speed of rotation  $v_1$  of the 30 disc is different from the speed of rotation  $v_2$  of the circular ring. The tablet is entrained and must bridge the gap 22 whose width increases continuously throughout about half the circumference to again decrease. This is 35 illustrated in Figs 2-5. Tablets whose edges have been damaged or which have an undersize diameter, will thus drop through the gap. Local edge damage is discovered, since each tablet is caused to rotate about its own axis

in the channel. Substandard tablets are thus sorted out. Concurrently with the rejection of damaged tablets, tablet dust and fragments entering the device 2 in connection with the filling thereof are removed.

5        Intact tablets having the desired diameter are displaced a full revolution in the channel, and are discharged through the duct 36. With the inventive device, it is possible to meet very narrow tolerance requirements. Thanks to the gentle handling of the tablets by using the 10 curved arm, combined with relatively low, different rotational speeds of the circular ring and the disc, especially in combination with the flexible member, it is possible to minimise the amount of waste resulting from rough handling of the tablets. The comparatively large receiving 15 area formed by the slot provided in the inner sideboard entails a high sorting and discharging speed, which contributes to a high efficiency of the entire plant. The inventive device is of a relatively simple design which also is highly cost-effective.

20       Although the device of the invention as described above is a preferred embodiment, it is understood that a man skilled in the art may find other means and modifications to achieve the same technical effect. Thus, the device is versatile by being easily adjusted to different 25 tablet sizes. The maximum width of the gap can thus be varied by changing the eccentricity between the disc and the ring, or by changing the disc and/or the ring. The width of the channel can be easily changed if the inner and the outer sideboard consist of a highly flexible material. The exit end of the channel can also be designed 30 otherwise. For instance, the outer sideboard can be formed with a slot in the area of the channel end, whereby tablets, by a suitable design of the inner sideboard, can be gently pushed out through the slot on to e.g. a sloping 35 plane or a conveyor. It is understood that the speed ratios and the rotational directions mentioned in the description merely serve as examples. Thus, the ring may,

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for instance, rotate in the opposite direction with respect to the rotational direction of the disc. All such modifications as fall within the scope of the inventive concept should therefore be comprised by the claimed scope  
5 of protection.

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## CLAIMS

1. Device for sorting round, flat products, comprising a channel and a disc rotating at a speed  $v_1$  and engaging each product, characterised in that the channel is formed by an inner sideboard (30) and an outer sideboard (32) which constitute the side walls of the channel, that the inner sideboard (30) is arranged immediately above the top face (18) of the disc (16), inwardly of the disc rim, the rim portion of the disc forming a first part of the bottom of the channel, that the outer sideboard (32) is arranged at a constant distance from the inner sideboard (30) which but slightly exceeds the diameter of the product (4), that a circular ring (12) is provided eccentrically in relation to the disc (16), that the top face (20) of the ring (12) is located in the same plane as the top face (18) of the disc (16), the ring (12) having an inner diameter exceeding the outer diameter of the disc (16), there being formed between the circular ring (12) and the disc (16) a gap (22) whose width varies in the circumferential direction and maximally is only slightly smaller than the diameter of the product, the part of the top face (20) of the ring (12) located inwardly of the outer sideboard (32) forming a second part of the bottom of the channel, and that a slot (34) is provided in the inner sideboard (30) and has such a length and such a height that a product located on the top face (18) of the disc (16) can pass under the inner sideboard (30) into the channel, the product being conducted out of the channel at the end thereof as a result of a corresponding design of the inner sideboard and of the outer sideboard.
2. Device as claimed in claim 1, characterised in that the circular ring (12) is rotatably supported by a plurality of wheels or rollers (6, 8, 10), of

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which at least one roller (6, 8 or 10) is designed as a driving roller.

3. Device as claimed in claim 2, characterised in that the circular ring (12) is driven by frictional engagement with the driving roller.

4. Device as claimed in claim 2, characterised in that the rim of the circular ring (12) is provided with teeth meshing with a driving gear wheel.

5. Device as claimed in any one of claims 1-4,  
10 characterised in that the circular ring (12) is rotating at a speed  $v_2$  which is different from the speed  $v_1$  of the disc (16).

6. Device as claimed in claim 5, characterised in that the speed  $v_2$  of the circular ring (12) is  
15 higher than zero, and that the rotational direction of the circular ring (12) and of the disc (16) is the same.

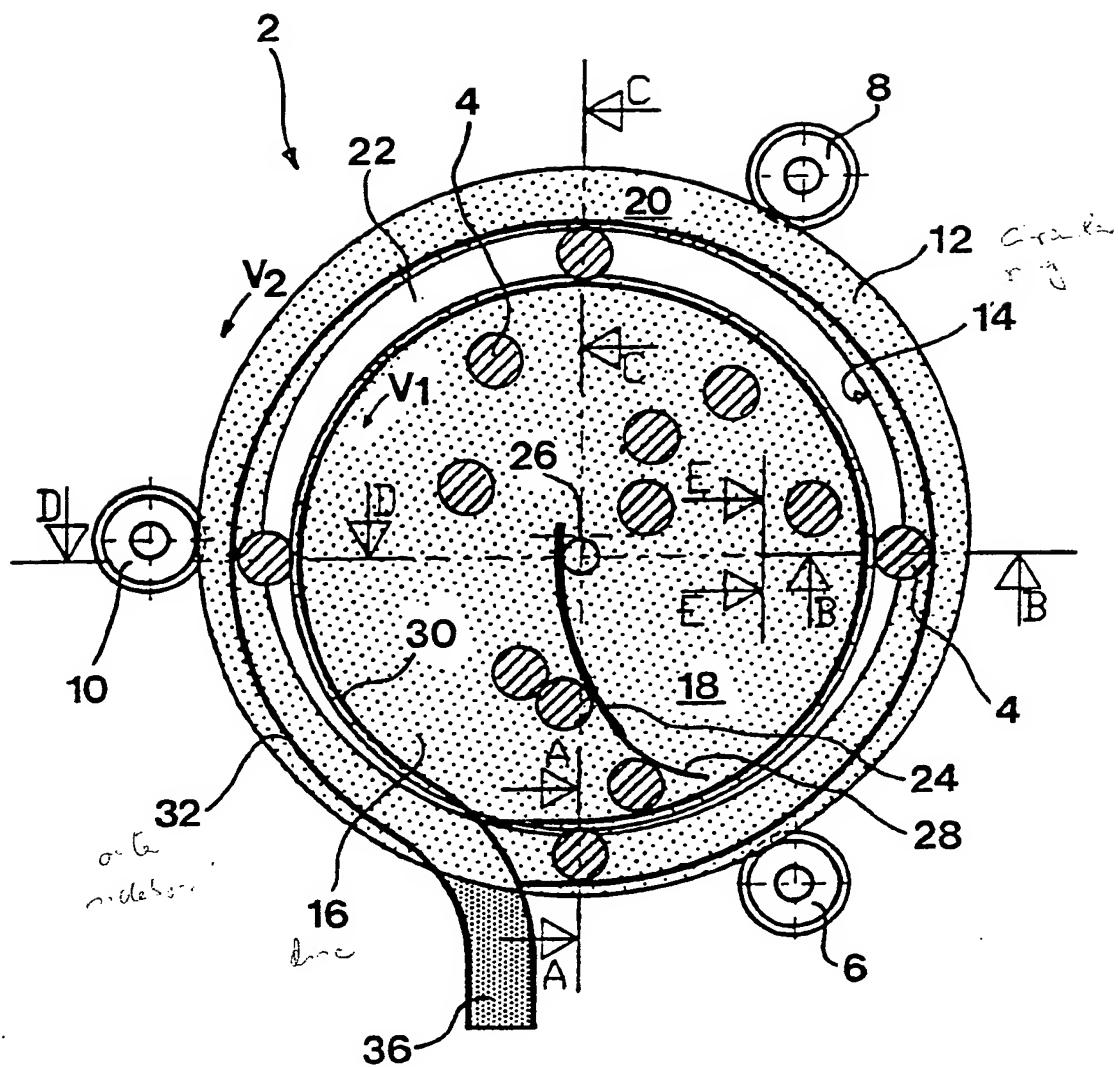
7. Device as claimed in claim 6, characterised in that the speed of rotation  $v_2$  of the circular ring (12) is higher than the speed of rotation  $v_1$  of the  
20 disc (16).

8. Device as claimed in any one of claims 1-7, characterised by an elongate arm (24) extended from the centre of the disc (16) towards the inner sideboard (30) and arranged immediately above the top face  
25 (18) of the disc.

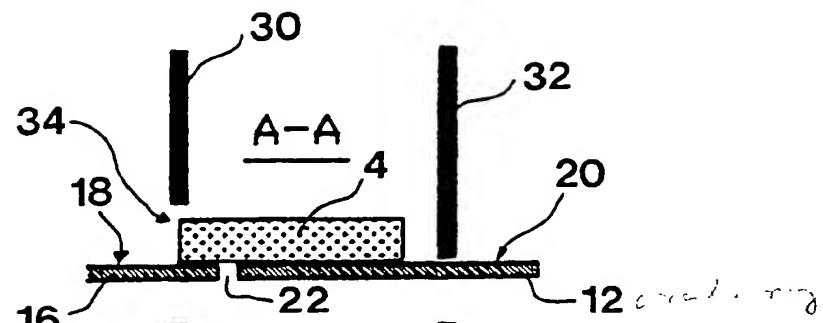
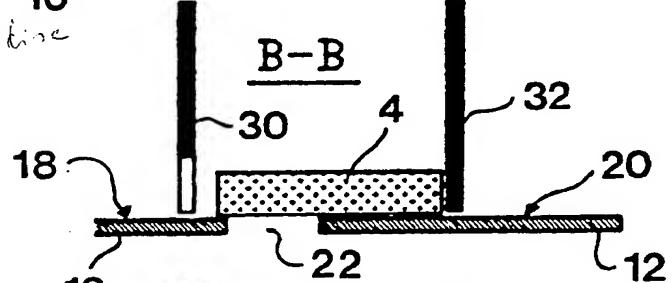
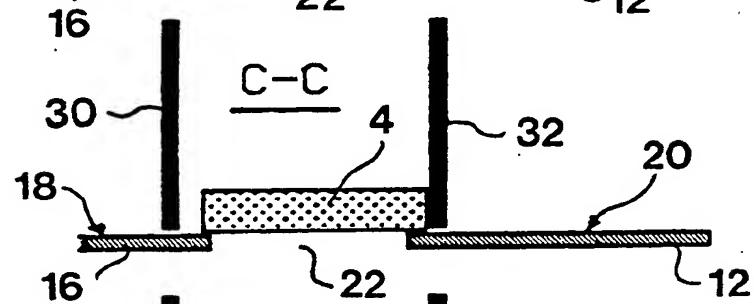
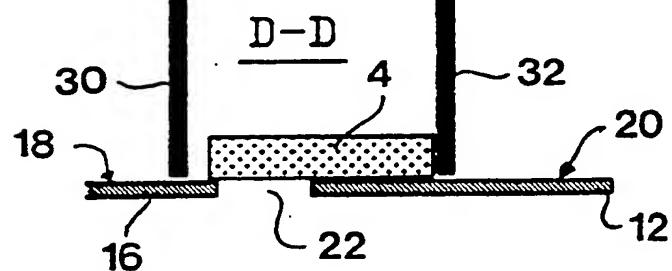
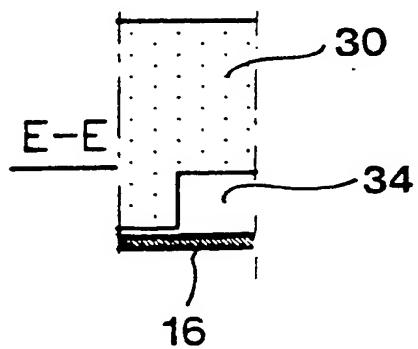
9. Device as claimed in claim 8, characterised in that the arm (24) is curved in the direction of rotation of the disc (16), and that the distal end of the arm with respect to the disc centre passes into a  
30 flexible member (28) also curved in the direction of rotation of the disc.

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FIG.1



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**FIG.2****FIG.3****FIG.4****FIG.5****FIG.6**

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE 92/00340

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)<sup>5</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

**IPC5: B 07 C 5/06**

## II. FIELDS SEARCHED

Minimum Documentation Searched<sup>7</sup>

Classification System	Classification Symbols
IPC5	B 07 B, B 07 C, G 07 D

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in Fields Searched<sup>8</sup>

SE,DK,FI,NO classes as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup>

Category	Citation of Document <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	DE, A, 2125666 (EDWIN BRASSEL) 23 December 1971, see page 6, line 8 – page 7, line 10; figures 1,2 --	1
A	WO, A1, 8909098 (KABIVITRUM AB) 5 October 1989, see abstract -- -----	1

### \* Special categories of cited documents:<sup>10</sup>

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## IV. CERTIFICATION

Date of the Actual Completion of the International Search

29th September 1992

Date of Mailing of this International Search Report

05 -10- 1992

International Searching Authority

SWEDISH PATENT OFFICE

Signature of Authorized Officer

*Bertil Nordenberg*  
BERTIL NORDENBERG

ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 92/00340

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the Swedish Patent Office EDP file on 28/08/92.  
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-A- 2125666	71-12-23	CH-A-	525724	72-07-31
WO-A1- 8909098	89-10-05	EP-A-	0334825	89-09-27
		EP-A-	0364555	90-04-25
		JP-T-	2503651	90-11-01
		SE-B-C-	460766	89-11-20
		SE-A-	8801120	89-09-26
		US-A-	5052562	91-10-01